

TeraScale Browser Manual

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Preface

- Scope:** The TeraScale Browser (TSB) provides a set of software tools and a viewer for constructing and displaying graphical objects that are derived from and visually represent a data set that meets certain requirements. This manual tells how to set up and install the TSB, how to run it, how to use it effectively to convert data for viewing and select alternative visualizations, how to use the options and controls that accompany each window, and how to perform typical visualization tasks.
- Availability:** The TSB currently runs on SGI machines under the UNIX operating system.
- Consultant:** During TSB development, contact Randall Frank (frank12@llnl.gov) for information on installation and access. For general help contact the LC customer service and support hotline at 925-422-4531 (open e-mail: lc-hotline@llnl.gov, SCF e-mail: lc-hotline@pop.llnl.gov).
- Printing:** The print file for this document can be found at:

on the OCF: <http://www.llnl.gov/LCdocs/tsb/tsb.pdf>
on the SCF: https://lc.llnl.gov/LCdocs/tsb/tsb_scf.pdf

Introduction

This section is under development.

Strategies for Effective Use

Possible Uses and Output

Why run this tool?

Scalability as a benefit?

Comparison with alternative tools, such as Open DX Data Explorer.

Based on your input data, TSB can make and display your choice of three forms of browsable graphical output:

- **ISOSURFACES:**
When you provide one or more specific values of a scalar variable associated with either the nodes or cell centers of a mesh (suitably "converted" from your raw data), TSB will generate and display a 3-D isosurface that joins all the points within the mesh that have the specified value(s). Values with no corresponding surface are ignored.
- **MATERIAL BOUNDARIES:**
When you provide the identifying "material" numbers or names (or any distinguishing tags) for several regions of the material decomposition a mesh, TSB will generate and display as 3-D surfaces the boundaries of those regions ("materials").
- **VOLUMES and SLICES:**
You can request that TSB sample the value of a scalar variable at each point in a specified 3-D matrix ("brick") of points within a mesh to create volumes or orthogonal slices, and then you can
(A) slide a "cutting plane" through the brick perpendicular to any axis and see isocontours of the scalar variable displayed on that plane, or
(B) display entire regions as a translucent 3-D structure in which varying color intensity and opacity correspond to different values of the scalar variable.

Prerequisites and Pitfalls

TSB Prerequisites

TSB assumes that your simulation output, which serves as its raw input, has these properties:

- Is a 3-D mesh (and follows the standard SILO library file-family naming and numbering conventions, as summarized for troubleshooting in [Appendix A](#) (page 52)).
- Associates the value of one or more scalar (or vector?) variables with each of the mesh's nodes or cell centers.
- Is either unstructured or topologically rectangular.
- Is a series or family of files that represent successive states of the mesh through time (timesteps).
- Orders the timesteps in the file family temporally.

TSB Pitfalls

Known pitfalls or limitations that you might encounter while using TSB include:

Scalar variables only?

Any way to cull or disable data flaws?

Any way to save a session's display settings for reliable reuse?

Underlying Features

Your goal is naturally to apply TSB rather than to study its internal mechanisms. But a little strategic knowledge of how TSB works can help you to

- (a) run it more reliably and astutely, and
- (b) detect inadvertent output problems resulting from artifacts in the visualization process itself.

Three Data Phases

Data sets pass through three phases (and three places (page 9), next subsection) on their way to visually displayed output from TSB:

| | | | | |
|---|------------------------|---|-------------------------|--|
| Phase 0 | ->data conversion-> | Phase I | ->data preparation-> | Phase II |
| mesh simulation timestep files | | TSB reconfigured data files, managed by: * user data label, * destination directory, * registry file (xxx.reg) [Toteboard summarizes properties for users] | | TSB browsable graphical objects (labeled): * isosurfaces, * material boundaries, * volumes and slices |

Phase 0, your input.

TSB accepts computed SILO-mesh simulation timesteps as input, currently with the constraints described above in the "Prerequisites" (page 6) section. TSB then processes this input data in two stages, using control choices that you specify.

Phase I, TSB reconfigured data.

Using the specifications that you provide on the "Browser Phase I Tool" window, TSB "converts" the Phase-0 data into a corresponding family of reconfigured data files (one file for each processed timestep), organized for subsequent use in a directory tree whose parent you specify. Accompanying the converted (Phase-1 reconfigured) data are several features that TSB uses internally to manage that data:

| | |
|--------------------|---|
| User Data Label | is a user-supplied text string that later identifies the whole tree of reconfigured data files (to enable easy reuse, deletion, etc.) and the corresponding simulation-domain bounds (as an overall DOMAIN label appearing in the <u>Browser Interface</u> (page 25) Viz List). |
| Destination | is the user-supplied parent directory in whose subdirectories the reconfigured data files reside. |

Registry is the directory that you specify indirectly (when you give the path to the registry file, below), in whose subdirectories the browsable graphical object files will reside (after Phase II completes).

Registry File (xxx.reg)

is a map (used by TSB internally) that identifies each browsable object (and hence, file) that the program generates from your reconfigured data by following your instructions. You can specify new registries (with separate registry files) to segregate data if you wish, or repeatedly use the same registry (with an expanded registry file) to simply enlarge previous (perhaps pilot) sets of graphical objects. (Typically you use one registry file per registry directory.)

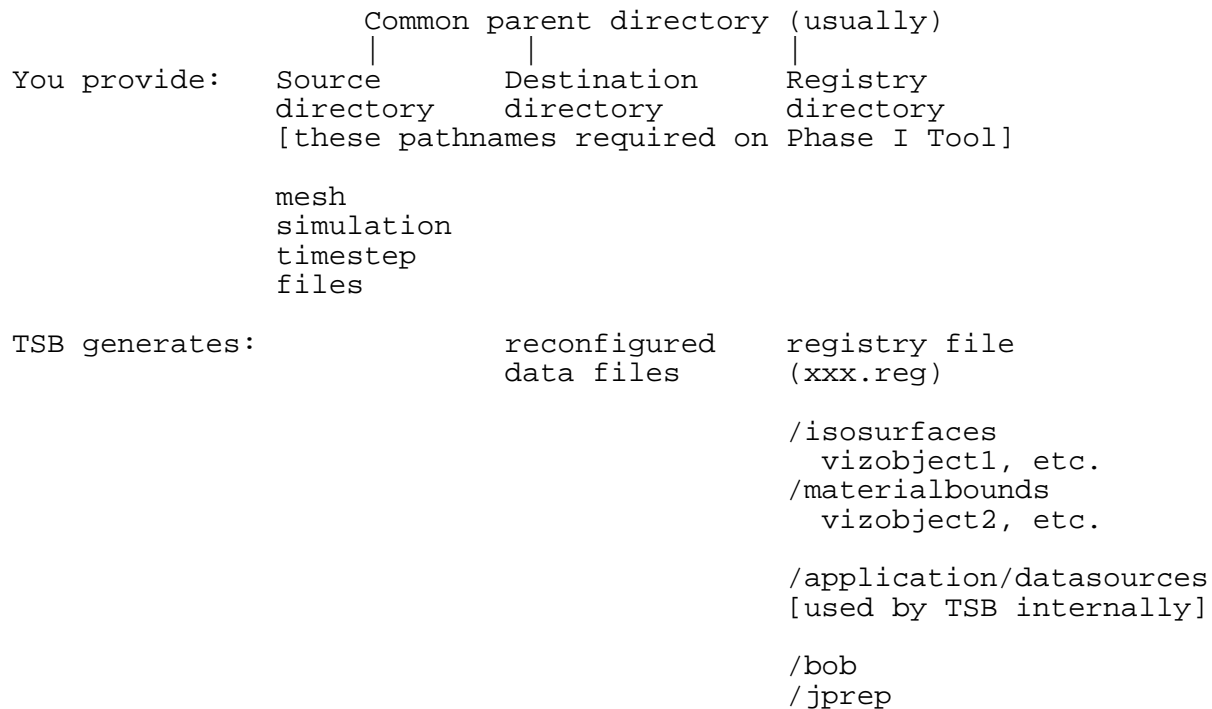
Toteboard is a small window that summarizes the found properties and limits of your reconfigured data, helpful for planning specific graphical objects during Phase II.

Phase II, TSB browsable graphical objects.

Using the specifications that you provide on the "Browser Phase II Tool" window, TSB "prepares" your selections from the Phase-I reconfigured data into browsable graphical objects (and their corresponding files). It lists the objects in your registry file and puts their files in your registry directory. The details depend on which of three kinds (page 5) of graphical output you select.

TSB Directory Structure

The previous subsection introduced the three directories used by TSB from the perspective of how the software works and the three phases through which data sets pass from input to graphical output. This section compares those directories (and their subdirectories) in more detail, and from the perspective of what you need to provide and what the program generates for you in response (but often hidden).



That the three user-provided directories have a common parent is not required, just recommended for easier, more orderly use of TSB. Users with very large data sets will naturally need to create these three directories only where a file system is big enough to meet their capacity needs.

Although the registry file (a catalog of your graphical objects) is referred to by its file name, TSB uses descriptive user-supplied labels to refer to the data in the destination directory and to the graphical objects in the registry directory. The [next section](#) (page 10) explains these labels.

TSB Labels and Names

TSB uses two kinds of labels to let you and the software itself uniquely identify, select, and manipulate its underlying visualization files (including your reconfigured input data in the "destination directory" and the graphical-object files that you make in the "registry directory"). The two kinds of labels fill two different roles (roughly, managing output from Phase I and output from Phase II). By paying attention to your choice of labels and their roles you can run TSB more effectively, especially if you revisit the same data many times.

This chart reveals the properties of each kind of TSB label and compares them feature by feature to minimize confusion:

| | User Data Label ----- | [Graphical Object] Label(s) ----- |
|-----------------------|--|---|
| Created/specified on: | Phase I Tool | Phase II Tool (left half) |
| Deletable on: | Phase I Tool | Phase II Tool (left half) |
| How many: | one per processed data set | one per unique graphical object |
| Role(s): | (1) identify each reconfigured data set (2) identify "bounding box" of each data domain | (1) identify each graphical object that you make |
| Appears in: | (1) Browser window Viz List as <DOMAIN> label (2) Phase I UDL pull-down menu (3) TSB internal clean-up control file | (1) Browser window Viz List as <object> label(s) (2) registry file for this graphical-object collection |

Note also that other TSB windows identify important information **WITHOUT** using either of these labels:

- On the main viewer ("Interactive Slicer") window, you specify a set of related graphical objects to view by providing the full pathname of its registry file (no labels involved).

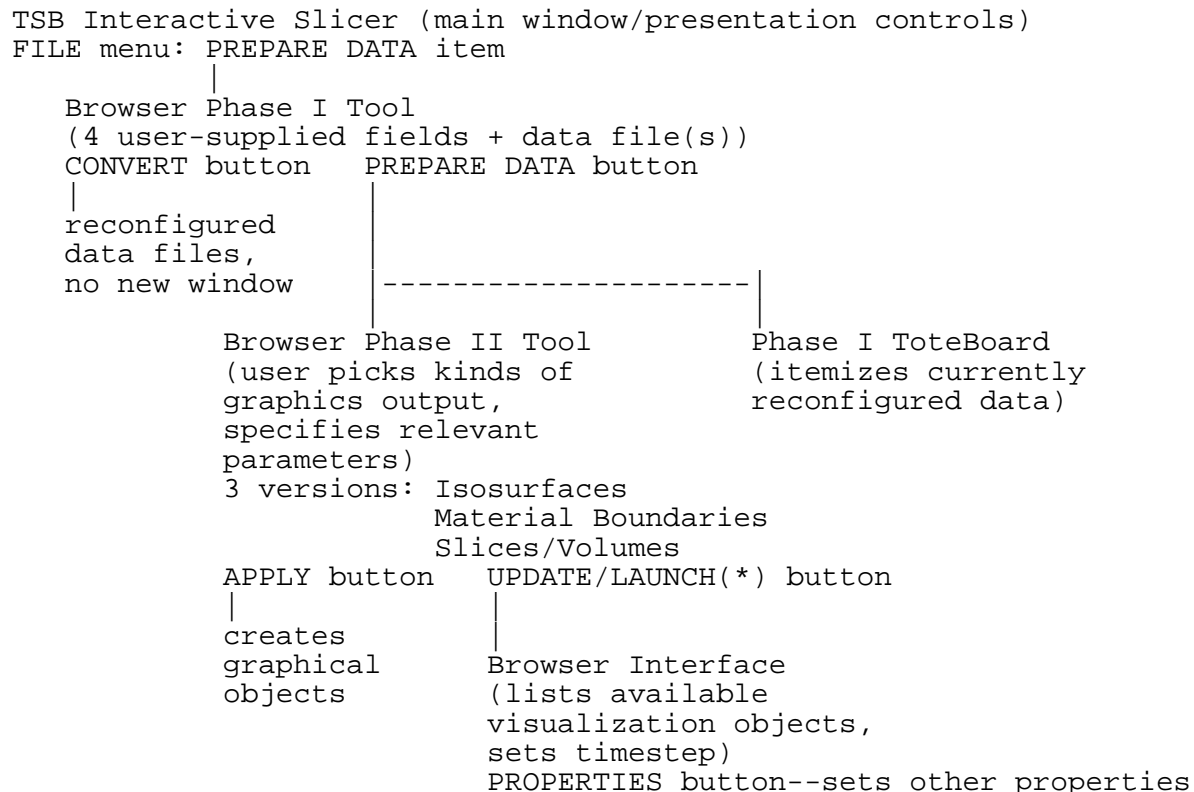
- On the Phase I Toteboard that appears after you "convert" (reconfigure) some input data, the discovered properties of the newly created visualization domain are summarized without reference to the User Data Label that you associated with that reconfigured data.

Typical Usage Paths

There is no single correct way to use the many available features (and controls) that TSB offers. But certain dominant paths (from raw data to successful visualization) reveal the tool's intended use.

Typical-Path Diagram

This chart lists the primary TSB windows and shows the flow of control among them. It represents a typical path (overt steps in the next section) for preparing and then viewing previously unprocessed data files with TSB.



(*)You UPDATE the main viewer if you started from it (normal);
you LAUNCH the viewer only if you started from Phase II (SlicerPrep).

Typical-Path Steps

These are the typical steps to input your simulation (mesh) data files into TSB, process them, and then view the resulting visualizations.

1. Create Needed Directories (page 9).

If they do not already exist (from previous TSB use), create (MKDIR)

- (a) a source directory to hold your input (mesh) files, and
- (b) a separate destination directory to hold the reconfigured data that TSB generates, and
- (c) a registry directory to hold your registry (map) file and the subdirectories that will contain the graphical-object files that you build with TSB.

2. Move Your Data.

If your computed simulation (mesh) data files are not already on the computer where you will run TSB, move (copy) them:

- (a) Execute FTP and request BINARY mode.
- (b) Deposit the files into your previously created source directory.

3. Launch the Browser Phase I Tool.

Either execute the main TSB program and select "Prepare Data" from the FILE menu (as shown in the previous section), or execute SlicerPrep from the command line (most easily done while in your source-file directory).

4. Supply Control Information.

To enable the CONVERT button, you must first supply four items, each in its appropriate field on the Browser Phase I Tool (page 27) window (end each with a RETURN):

- (i) Data Source Path--the directory to search for your input (simulation mesh timestep) files.
- (ii) Data Destination Path--the top-level directory into which to deposit the reconfigured data files that TSB makes (differs from your registry directory, see (iii)).
- (iii) Registry File--the full pathname for your map file (and hence, for the "registry directory" where it resides), by which TSB manages your reconfigured data and (later) browsable graphics files.
- (iv) User Data Label--a unique identifying string for later unambiguously referencing this set of generated files and directories.

You must also pick at least one specific input data file (usually many) from the list that this window offers, based on choice (i) above.

5. Convert Data.

Completing step 4 enables the CONVERT button on the Browser Phase I Tool window. Click on it and TSB generates a "reconfigured data" file for each input timestep that you selected, stores them in your chosen destination directory, and enters one "bounding box object" for this whole simulation domain into your registry directory's registry file. Successful completion of this conversion also enables the PREPARE DATA button on the same window.

6. Prepare Data.

Click on the PREPARE DATA button to start the (multistep) process of creating Phase II output. Activating this button spawns two new windows:

- (a) The Phase I ToteBoard, a reporting window that summarizes the characteristics of the currently selected reconfigured data (e.g., the number of problem cycles, the limiting values of each variable).
- (b) The Browser Phase II Tool, a control window for finishing the generation of graphical objects from your data (next step).

7. Pick a Type of Visualization.

The Browser Phase II Tool (page 30) window divides into left and right halves vertically. The top left side always asks you to

- (a) select or specify a graphical-object label (the current "user data label" borrowed from Phase I is the default), and
- (b) select the type of visualized output you want. The choices are isosurfaces (the default), material boundaries, or slices/volumes (as contrasted in the "Possible Uses" (page 5) section above). Your choice of visualization type determines the specific fields that appear on the right half of the Browser Phase II Tool window (there is a right half-window customized for each kind of graphical object).

8. Supply Visualization Parameters.

- (a) GENERAL. The lower left half (page 30) of the Browser Phase II Tool window always asks you to specify the range of timesteps you want visualized and the geometric range to cover from the reconfigured data's 3-D coordinate system (all involve picking maximum and minimum values). These choices together with a CREATE button let you make a "bounding box object," with a limiting set of general graphical attributes that all of your specific graphical objects will inherit. (You can also do this using the TSB view window's "selection box" option.)
- (b) SPECIFIC. The right half of the Browser Phase II Tool window changes based on your choice of visualization type (in the left half). You may need to specify variables and their values for isosurface (page 34) plots, or the boundaries (page 36) of volumes to be rendered or sliced, or the "materials" (page 38) into which you want a plot decomposed. These object-specific parameters (for which specific fields appear on the right side) combine with the general attributes (left side) to define the graphical objects that TSB generates from your data.

9. Create Graphical Objects (Apply).

Completing all fields on the Browser Phase II Tool window (left and right halves) enables the APPLY button in the window's lower left corner. Click on APPLY to generate the graphical object (then listed in your registry file) and the corresponding files(s) (then stored in a child of your registry directory) that implement the visualization choices you have made in previous steps.

10. View.

- (a) Click on the LAUNCH BROWSER button (next to APPLY) on the Browser Phase II Tool window to spawn the Browser Interface (page 25) window. This window offers a list of available graphical objects to display (select one), a timestep control panel (default is 0), and arrow buttons that display a single timestep (single arrow) or animate through all timesteps (double arrow) in either direction.
- (b) If a browser window is already in play because you started from the main TSB viewer and worked your way to the Phase I and Phase II Tools, then this button bar will instead let you UPDATE your Browser Interface (page 25) "Viz List" to display your newly generated output.
- (c) Many display controls are available on the main viewer (Interactive Slicer (page 20)) window. Also see the "Multiple Views (page 45) of one Visualization" example in a later section for comparative cases of typical viewing output.

Installation and Set Up

This section is under development.

Execution

This section explains how to start a TSB session, how to change TSB operational defaults (needed only for special purposes, such as driving a wall-sized multimonitor display), and how TSB reports errors during execution.

How to Run TSB

To run TSB, first set the environment variable `ASCIVIZ_HOME` to the directory (or path of directories) one level above the `(/bin)` directory where the TSB executable files reside. For example, if the TSB files are installed (page 16) in `/ascviz/bin`, then under the C shell you could type

```
setenv ASCIVIZ_HOME ascviz
```

Second, execute the SLICER file by typing its pathname, such as:

```
/ascviz/bin/slicer
```

This launches both the main viewer window ("Interactive Slicer") and its associated "Browser Interface" window, both described in detail in "Viewing Output" (page 20) below. WARNING: SLICER will NOT run successfully in background without special options (all processes stop but do not exit, and must be killed). To run SLICER in background and avoid the need for a second terminal window, use this special execute line:

```
/ascviz/bin/slicer -nostdin &
```

Third, select items from the main viewer window's FILE (pull-down) menu to pursue your desired visualization tasks. Typical choices include:

PROCESS new data.

Select PREPARE DATA from the FILE menu. This executes the SlicerPrep program and spawns the TSB "Phase I Tool" (page 27) window, the first step in reconfiguring and converting mesh data for your choice of visual output. See "Typical-Path Steps" (page 13) if you need help continuing with the TSB data preparation process. The preparation tools and the TSB viewer communicate with each other so that you can display new graphical objects as soon as you make them (see below).

VIEW previously made graphical objects.

Select OPEN REGISTRY FILE from the FILE menu. This spawns a selection window in which you must specify (by clicking, filtering, or typing into the "Selection" field) the full pathname of the TSB registry file (page 7) (`xxx.reg`, made in a previous TSB session) that identifies the available objects that you want to display. Choosing a registry file populates the "Browser Interface" window with a list of preprocessed objects (the Viz List). Picking from this list displays the corresponding object in the main viewer window (the first object listed displays by default, or use the LOAD button).

Change the object's PRESENTATION.

Use the controls offered on the main viewer widow (details in the "Interactive Slicer" (page 20) section below, or see the first example (page 45)) to change how your chosen graphical object is presented without changing the properties of the object itself. For example, you can:

- (a) MANIPULATE the displayed object with the help of the cursor controls (icons in the vertical strip on the right edge), or
- (b) ALTER the background or date display using choices from the APPEARANCE menu (top bar), or
- (c) ROTATE the object and change its apparent distance with the control "wheels" (bottom edges).

Change the object's PROPERTIES.

Use the PROPERTIES button (right side) on the Browser Interface (page 25) window to spawn a separate property-setting window specific to each kind of graphical object that you view. Changing the settings and sliders on these object-specific property-setting windows (details in the "Setting Object Properties" (page 40) section below, and in the first example (page 45)) changes the features of your displayed object (such as the direction of shown slices or the object's transparency) without changing the mere presentation of the object (described in the item above). Because all objects involve multiple timesteps, you change displayed timesteps on the Browser Interface itself rather than on the specific property-setting windows.

TSB Defaults

By default TSB displays to the terminal from which it is run, but you can supply a configuration file that causes TSB to display "externally," for example, in a visualization theater to a wall of interlinked monitors.

Error Reporting

TSB reports errors to the terminal window from which you started it. For example, if you have set `ASCIVIZ_HOME` improperly, TSB will not be able to find the executable file it needs (SlicerPrep) to run when you select the PREPARE DATA button, and it will report to your terminal the failing path that it tried.

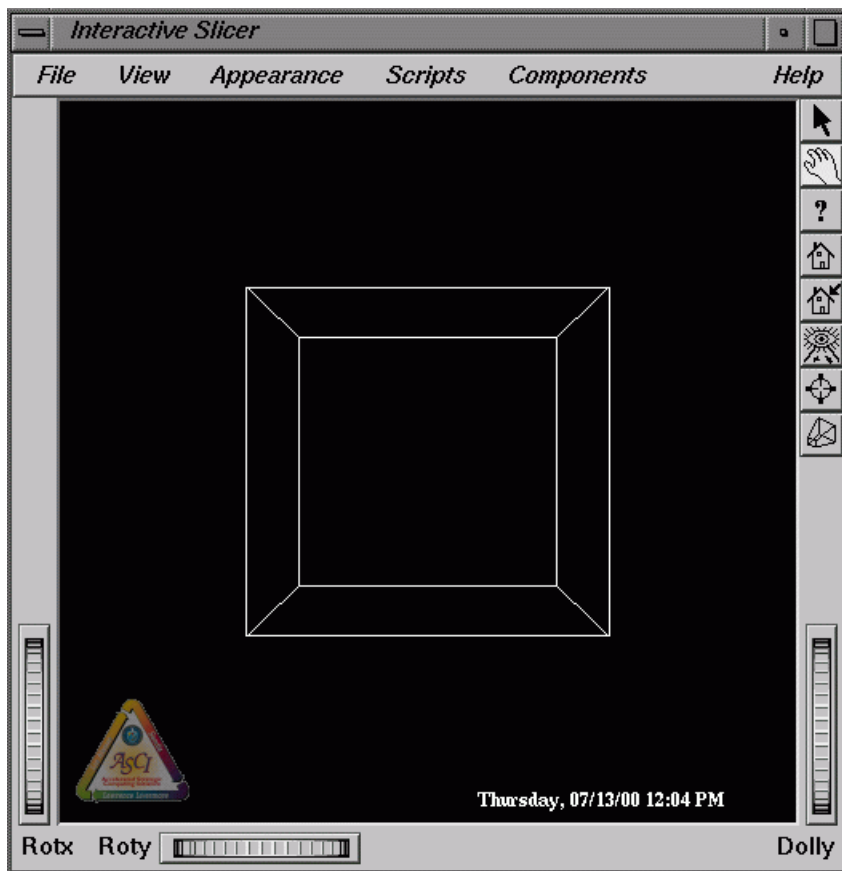
Windows and their Options

This section gives a window-by-window, button-by-button inventory of what you can do, set, and select while running TSB. The windows are grouped by their broad functions or roles.

Viewing Output

Main Viewer (Interactive Slicer)

This is the main display window, from which you show and manipulate graphical objects, set your viewing preferences, and launch the data-preparation windows discussed in the next subsection.



The user-interaction features of the TSB main viewer ("Interactive Slicer") window include (grouped by location on the window):

Toolbar (top horizontal strip).

File offers a menu of basic choices to control the viewer, including:

- New clears all current registry data.
- Open Registry File opens the registry file (previously made inventory of graphical objects) whose full pathname you specify or select. Specifying a registry file here then populates the "Viz List" in the Browser Interface (page 25) window, from which you can pick an object to display.
- Prepare Data starts a data-preparation session (to "convert" raw mesh data and construct graphical objects) by launching the Phase I Tool window (described in the next section (page 27)).
- Print sends a PostScript or RGB version of the currently displayed image to a networked printer that you specify, or to a file whose name you supply. You specify the image size, dots/inch, and output file name in a spawned "ScreenViewer Printing" window.
- Preferences launches the Preferences dialog box (page 44) to enable you to (somewhat) control how the viewer runs (mostly sets the cache and prefetch levels). See the "Setting and Monitoring Choices" section below. If you have not previously used this menu choice to store your preferences, the viewer reports that it "cannot open preferences file, using defaults" when you first execute it.
- Exit terminates TSB and closes all open windows, including any Phase I or Phase II Tool windows spawned from the main viewer window.

View lets you control the display of the graphical objects that the viewer presents, where:

- External Display selects an external display configuration that you specify with a VDL configuration file. This directs the viewer to drive such special instructional displays as a multimonitor "power wall," but you must use the -vdl option on the command line when you first execute the viewer to enable this menu choice.
- Remote Rendering allows the viewer to perform its rendering on a distant but larger machine (for example, in a client/server set up, you can force all rendering to the server side for faster service). A pull-down menu here also lets you set the "pixel zoom" to 1X (finest, the default), 2X, or 4X (the thickest).

| | |
|-------------------|--|
| Appearance | controls the look of the viewer window independently of the graphical objects displayed, where: |
| Logo | toggles the display of the ASCII (triangular) logo in the lower left corner of the viewer window. |
| Current Date Time | toggles display of the current day, date, and time in the lower right corner of the viewer window. |
| Background | offers four menu choices to specify the look of the display background against which your graphical objects appear, as well as use of a standard color editor to set the background color and intensity. The available background choices are: |
| Solid | (default) makes a plain, uniform background (black is the default color). |
| Ramp | gradually shades the background bottom to top from one dominant color to another (default shades from light blue to black). |
| Checked | makes a checkerboard background of large, alternate-colored squares. |
| Crosshatched | imposes a fairly thick grid with lines in one color over a uniform background in an alternate color. The grid has about 5 squares/inch and its default colors are blue lines over a black background. |
| Scripts | lets you use a previously built script of steps to drive the viewer through a series of displays that you capture in sequence, for example, to make a movie. |
| Run Script | selects and runs a specified command script. |

| | |
|---------------|---|
| Components | invokes either of two complex subcomponents to manage subsequent displays. The choices are: |
| Selection Box | superimposes a box over your displayed image that you can manipulate to visually define a subregion (for closer study), then pass that subregion's defining parameters to the Phase I and Phase II Tools for use when you process subsequent data. Use the "pick cursor" (top arrow among the icons along the view window's right side, see "Modes of Interaction" below) to scale the entire selection box from its corners, scale any face and its opposite one from its center, or move the box parallel to any face. Use the offered dialog window to move faces independently by moving the slider triangles or by typing a value in the text area. If you have spawned both the Phase I and Phase II Tool windows from the viewer window, then clicking OK on the dialog window sends your current selection box parameters to use as max/min values on the left (general) half of the <u>Phase II Tool</u> . (page 30) |
| Color Editor | invokes the standard <u>colormap editor</u> (page 40), whose use is explained in the "Setting Choices" section below. |

Mode-Of-Interaction Controls (icons, right side vertical strip).

| | |
|----------------|---|
| Pick Cursor | (arrow head) if enabled by a Components Selection Box menu choice, sizes the subregion selection box by moving its surfaces in the main viewer window or moving the X, Y, Z, and time set points (triangles) in the spawned Selection window. |
| Hand Cursor | (right hand outline) rotates the displayed image along any axis centered on the middle of its bounding box by visually "pushing" or "pulling" with the hand (same effect as using the Rotx or Roty wheel controls described below). |
| Help | (question mark) displays two screens of brief standardized help on viewer features. |
| Home | (house) returns the displayed graphical object to its original ("home") position, cancelling all rotations and zooms since home was last set (next icon). |
| Home Set | (house with arrow) resets "home" to the current position and shape of the displayed graphical object. |
| Enlargement | (eye atop mountain) enlarges the displayed graphical object by about 30% but keeps the same position relative to the user (same effect as using the Dolly wheel control). |
| Seek Cursor | (cross hairs) changes the interaction of the hand cursor (above) with the displayed graphical object (results are unpredictable and use is not recommended). |
| Foreshortening | (foreshortened rectangle) is a standard interface feature disabled in this application. |

Rotation Controls ("wheels" in bottom frame).

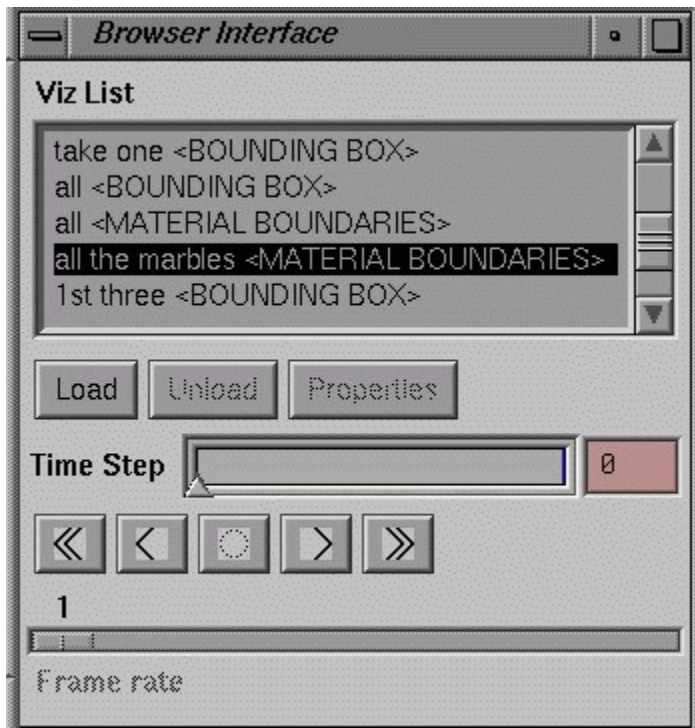
Rotx (left bottom) rotates the displayed graphical object around its X axis in either direction (same as hand cursor).

Roty (center bottom) rotates the displayed graphical object around its Y axis in either direction (same as hand cursor).

Dolly (right bottom) zooms in or out (changes the apparent distance of the displayed graphical object from the frame without any rotation or change of viewpoint).

Browser Interface

This is the main control window for the viewer, from which you load or unload existing graphical objects (by label) to display, and control the rate at which timesteps replace each other on the screen.



Viz List [scrollable selection box]

lists (by assigned label and object type) the available graphical objects in the previously made registry file that you have currently open. You can scroll the list and click on any item to select it for display in the main viewer window (see LOAD button below).

Load [button] enabled if you have selected a graphical object different than the one currently displayed in the viewer window, this button lets you load (display) your current choice in place of the previous one.

Unload [button] enabled if you have a graphical object on display, this button let you dispose of that image without selecting another.

Properties [button] spawns a subsidiary window to let you set the visual properties of the displayed object (such as slice direction). The details of this "properties window" (page 40) vary with the object displayed (ranging from a simple property list to an elaborate color editor).

Time Step [slider]

selects the (integer) timestep to display for the current graphical object. The range of available timesteps that this slider spans depends on what TSB found in your data during the data-preparation phase.

VCR (Arrow) Buttons

control the way in which the timesteps selected above display in the viewer window sequentially, where:

Circle [button] stops the display if previously started.

Single Arrow (either direction)

displays one next timestep (in either direction) with each click on the button.

Double Arrow (either direction)

begins sequentially displaying all available timesteps (in either direction) at a rate set by the Frame Rate slider (below) and continues as a looping animation through the timesteps until stopped.

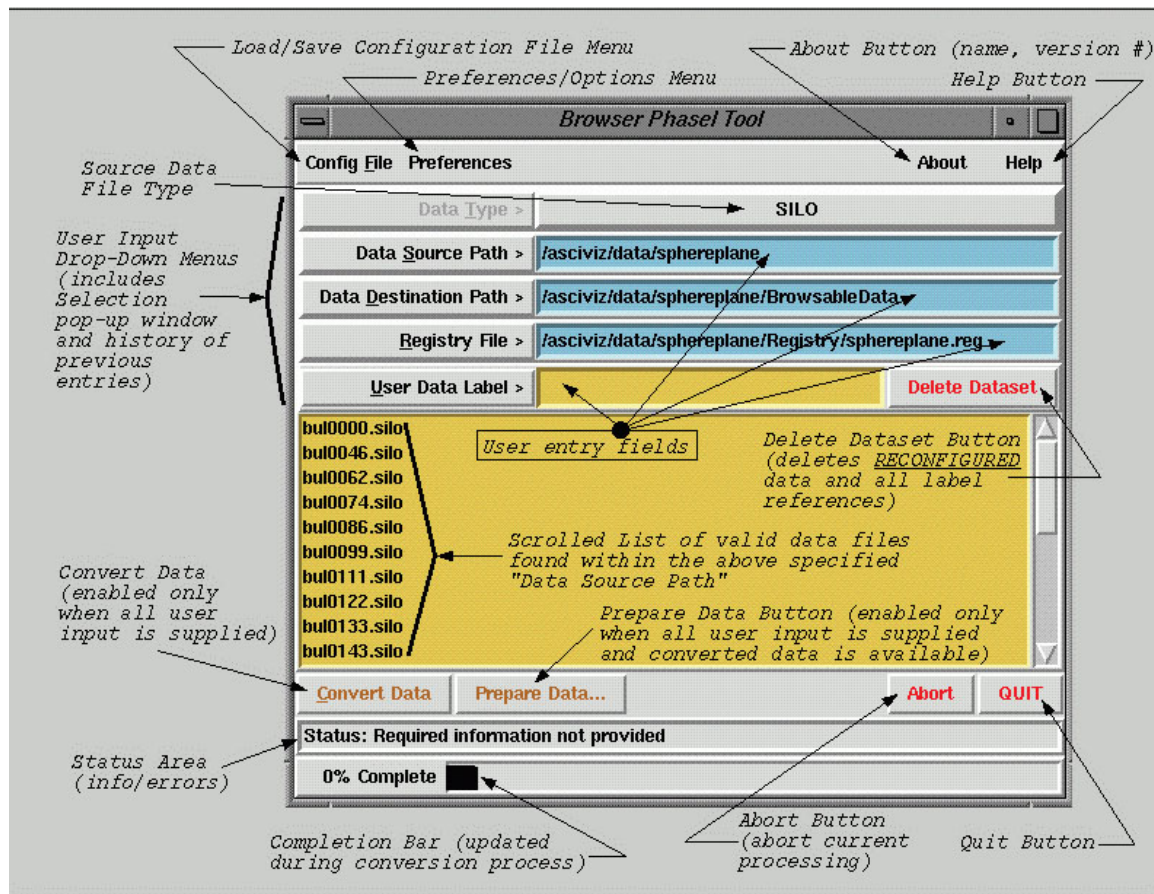
Frame Rate [slider]

sets the rate at which the viewer displays timesteps (during an animation) to any integer from 1 (step/second) to 32 (steps/second).

Preparing Data

For all the windows described in this section, whenever any mandatory user-entry field remains empty or invalid it appears in a reserved "disabled color" (currently yellow). When filled with valid user input, the field turns to a reserved "enabled color" (currently blue). Similar color signals indicate when action buttons are disabled (yellow) or enabled (blue).

Browser Phase I Tool



The user-interaction features of the Browser Phase I Tool window include (grouped by location on the window):

Toolbar (top horizontal strip).

Config File [menu]

allows you to Quit TSB, or Load or Save a configuration file [needs details on why and on file format].

Preferences [menu]

when populated, will allow you to customize your interaction with this window (currently you can only customize the Abort Time).

About [button]

displays this program's name and version number.

Help [button] launches the help service (not yet implemented).

User Specifications (middle five zones, all required).

Data Source Path [menu/field]

requires you to select a path from an offered, scrollable list or by using standard string filters, or enter a valid pathname into the field provided. End with a RETURN.

Your choice here becomes the directory that TSB searches for files with the proper data format (page 52) (e.g., SILO) to list in the scrollable list box (below) as candidates to process.

Data Destination Path [menu/field]

requires you to select a path from an offered, scrollable list or by using standard string filters, or enter a valid pathname into the field provided. End with a RETURN.

Your choice here becomes the top-level directory into which TSB deposits your reconfigured (converted) data files.

Registry File [menu/field]

requires you to select a file from an offered, scrollable list or by using standard string filters, or enter a valid filename into the field provided. End with a RETURN.

Your choice here becomes the file that contains all information (labels, identifiers, locations) for your prepared browsable graphics objects (the ones later listed for your selection in the Browser Interface window).

User Data Label [menu/field]

requires you to select a string from a pull-down menu of your previously invoked user data labels (if you have any), or enter a valid string into the field provided. End with a RETURN.

Your choice here becomes your unique Phase-I identifier for referencing all of the data (names, subdirectories, etc.) associated with this processing pass for future use (shows as an overall DOMAIN label in the Browser Interface window and supports clean, complete deletion of this Phase-I work later).

Scrollable Listbox [menu]

lists the names of all valid data files (those with a processable format) found within the source directory that you specified above (your Data Source Path). Use your mouse to highlight the file(s) that you want TSB to "reconfigure" (convert) to allow later graphical postprocessing (minimum: one file).

Delete Dataset [button]

deletes all files for and label references to the reconfigured (converted) data that you previously generated and associated with the specific, current "user data label" (the one in the field just to the left of the Delete Dataset button).

Action Bar (lower horizontal strip).

Convert Data [button]

executes the preparation tools to reconfigure (convert) the data file(s) that you selected, using the parameters that you specified in the five user-supplied fields in the middle of this window (and described above). A summary analysis of your processed data appears in a small, separately spawned window called Phase I Toteboard, and you can refer to this when filling the fields to create graphical objects during Phase II.

Prepare Data [button]

launches two windows: the Phase I ToteBoard (if not already present) and the Phase II Tool window, to let you further specify the visualization results that you want.

Abort [button]

(enabled after you have activated Convert Data, above) aborts the currently running Phase-I processing.

Quit [button] quits the Phase I application and exits TSB.

Browser Phase II Tool (Left Half)

Browser Phase II Tool

Config File Preferences About Help

Label > New and Improved

Isosurface(s) Volume(s) Slice(s) Material Bound(s)

Create Bounds Object

New and Improved Time Step Settings

Min TStep 0 Default (0)

Max TStep 20 Default (20)

New and Improved Geometric Settings

Min X 0.0 Default (0.0)

Max X 5.0 Default (5.0)

Min Y 0.0 Default (0.0)

Max Y 2.0 Default (2.0)

Min Z 0.0 Default (0.0)

Max Z 2.0 Default (2.0)

Variable >

d Iso Values

Iso Value 0.0455338 Default (0.0455338)

Accept Clear Entry Clear All

Resolution 128 Default (128)

Apply Launch Browser Abort QUIT

Status: Required information not provided.

0% Complete

The only way to launch the Browser Phase II Tool window is by activating the Prepare Data button (bottom left) on the Browser Phase I Tool window. The Prepare Data button is enabled after you (a) use that window's Convert Data button, or (b) select an existing label from the User Data Label pull-down menu, offered whenever you specify an existing registry file.

The Browser Phase II Tool window creates the specific graphical objects that you will later view. It divides into left and right halves vertically. On the left side you specify (a) the TYPE of graphical objects you want and (b) their general or global properties (field details described below). The right side of this

window changes based on your choice of graphical objects, and prompts you for specific characteristics relevant to just the type of visualization that you chose (field details in subsequent sections).

The user-interaction features of the Browser Phase II Tool window include (grouped by location on the window):

Toolbar (top horizontal strip).

Config File [menu]

allows you to Quit TSB, or Load or Save a configuration file [needs details on why and on file format].

Preferences [menu]

when populated, will allow you to customize your interaction with this window (currently you can only customize the Abort Time).

About [button]

displays this program's name and version number.

Help [button] launches the help service (not yet implemented).

User Specifications (visualization type, general properties).

Label [menu/field]

lists your previously specified graphical-object labels (identifiers) from your current registry file so you can select one (or you can enter a new label for a new graphical object in the field provided). There is no default label.

Delete Dataset [button]

after you select a label, deletes the corresponding (previously generated) graphical object data and all label references (used to clean up properly from earlier runs).

Graphical Object Type [choose radio button]

offers you a choice of one of three alternative types of visualization to construct (by picking one of three mutually exclusive radio buttons):

Isosurfaces (the default)

Volume(s)/Slice(s)

Material Boundaries.

Your choice automatically changes the right half of this (Phase II Tool) window so that only object-relevant fields and buttons appear to enable your further specification of your graphical output.

Create Bounds Object [checkbox]

creates a bounding box that is associated with your selected graphical objects and represents your specified minimum and maximum geometric settings (below). This places a displayable cube around the subregion that interests you, a visual convenience.

Time Step Settings [slider/field]

specifies the chronological limits you want imposed on the timestep data to be visualized, where:

Min TStep specifies the minimum timestep to process (default is always 0).

Max TStep specifies the maximum timestep to process (default is an integer derived from your reconfigured data during Phase I).

Geometric Settings [slider/field]

specifies the spatial limits you want imposed on the data to be visualized (based on your reconfigured data's 3-D coordinate system). In each case, TSB derives the default value either from its Phase-I analysis of your data, or from your overt use of the Components | Selection Box menu choice on the Phase-I toolbar (to identify your subregion of interest). Here:

Min X specifies the minimum X-direction value.

Max X specifies the maximum X-direction value.

Min Y specifies the minimum Y-direction value.

Max Y specifies the maximum Y-direction value.

Min Z specifies the minimum Z-direction value.

Max Z specifies the maximum Z-direction value.

Action Bar (lower horizontal strip).

Apply [button]

(enabled only after you have supplied all required fields) generates the graphical-object files (in subdirectories of your registry directory) that implement the visualization choices you have made when completing previous fields. APPLY also updates your registry file to reflect this new output.

Launch Browser [button]

launches a separate and independent TSB session for viewing your output.

NOTE: This button is only present if you launched the Browser Phase I and Phase II Tool windows from a command line and NOT from the TSB File menu's PREPARE DATA option (see next two buttons).

Update Browser Registry [button]

sends the current PhaseI/II Tool registry file name to an executing TSB session for subsequent reading (typically used when you have just added graphical objects). This updates the "Viz List" in the Browser Interface (page 25) window to show your newly created graphical objects, so you can pick them for display.

NOTE: This button is only present if you launched the Browser Phase I and Phase II Tool windows from the TSB File menu and a successful network connection has been made (see the Launch Browser button above).

Update Browser Data [button]

sends your general specification values (the max/min values that you specified on the left half of the Browser Phase II Tool window) to an executing TSB session (where they update the selection box attributes).

NOTE: This button is only present if you launched the Browser Phase I and Phase II Tool windows from the TSB File menu and a successful network connection has been made (see the Launch Browser button above).

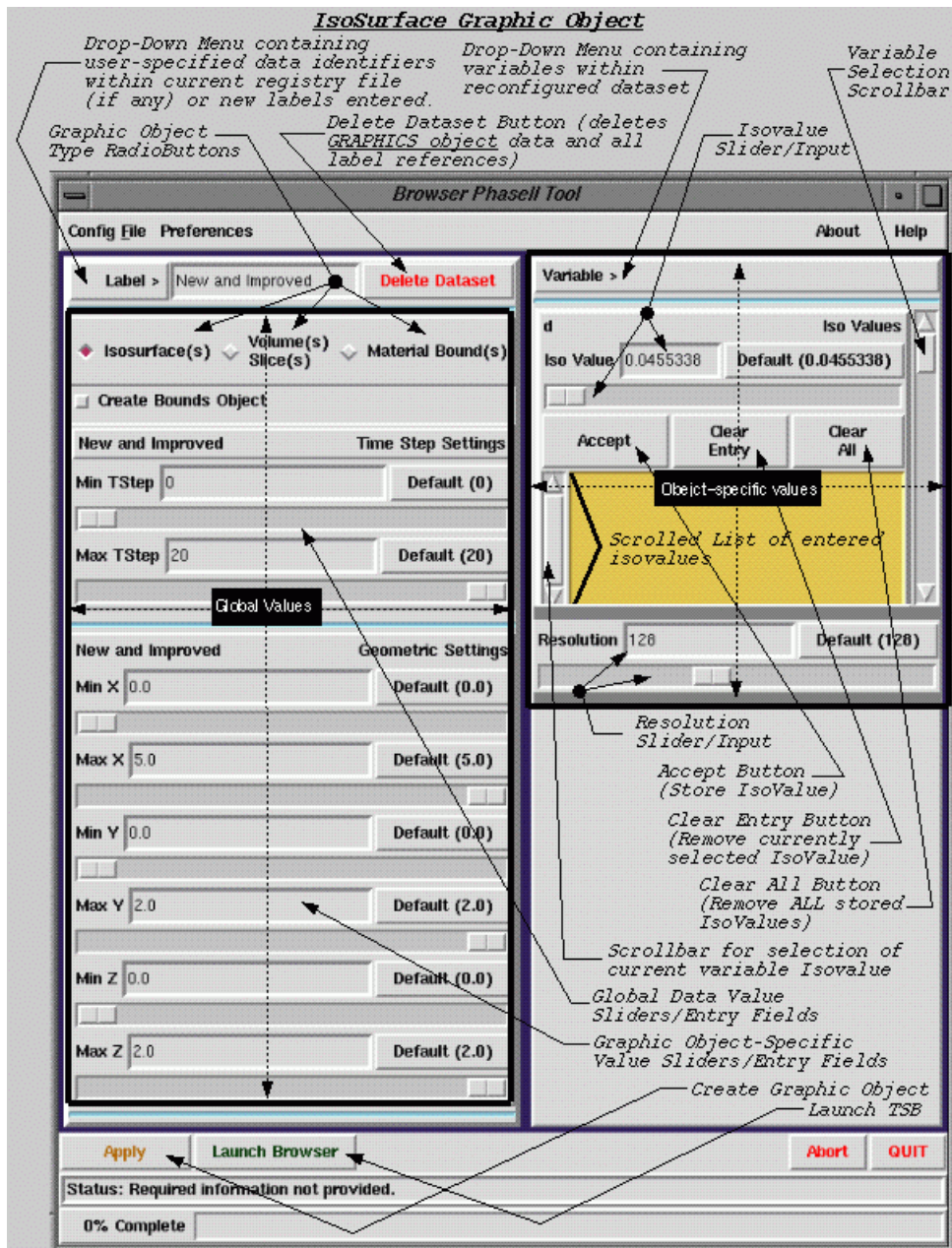
Abort [button]

(after you have activated APPLY, above) aborts the currently running Phase-II processing.

Quit [button]

quits the Phase-II application and exits TSB.

Phase II Isosurfaces



The Phase-II RIGHT half that specifically supports isosurfaces (shown above) appears by default, or if you activate the isosurfaces radio button near the top of the Phase-II LEFT half.

The user-interaction features of the Phase-II Tool isosurface right half include:

Variable [menu]

offers a pull-down menu that lists the variables found in your data during the Phase-I analysis. You can select any variable and then use the other features on this right half (described below) to pick isovalues for it whose isosurfaces will be plotted during Phase II.

Variable Selection Scrollbar

(right edge) scrolls through your previously selected variables to let you review, edit, or clear (any of) their associated isovalues.

Isovalue [field/slider]

lets you set (with the slider) or supply (in the field) one or more isovalues to plot as isosurfaces (for the current variable). The allowed range of values depends on the Phase-I analysis of your specific data, the default isovalue is the lowest found value for the currently selected variable, and integers are automatically converted to decimals.

Accept [button]

stores the currently specified isovalue for the current variable for subsequent plotting and display.

Clear Entry [button]

deletes the currently selected isovalue for the current variable.

Clear All [button]

deletes all stored isovalues for the current variable.

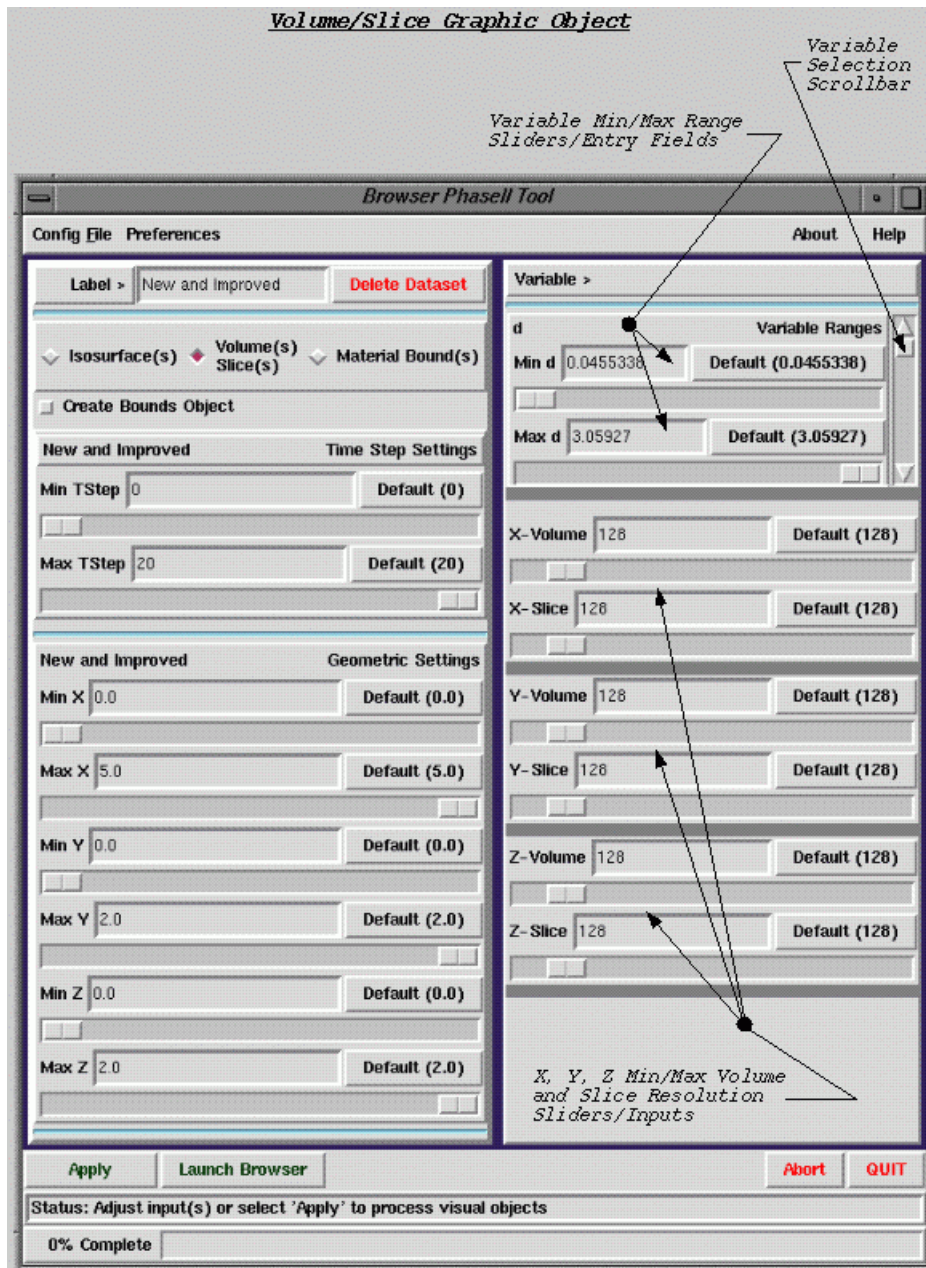
Scrolled List of Entered Isovalues

lets you review all the isovalues that you have picked so far for the currently selected variable (using the scrollbar on the left), or click on one to select it.

Resolution [field/slider]

lets you set (with the slider) or supply (in the field) an integer specifying the fraction of the data range that you will be able to visually distinguish. Small numbers are low resolution (32 means $1/32$), while large numbers are high resolution (128 means $1/128$), and the default resolution is the highest available.

Phase II Volumes/Slices



The Phase-II RIGHT half that specifically supports volumes and slices (shown above) appears just in case you activate the volumes/slices radio button near the top of the Phase-II LEFT half.

The user-interaction features of the Phase-II Tool volumes/slices right half include:

Variable [menu]

offers a pull-down menu that lists the variables found in your data during the Phase-I analysis. You can select any variable and then use the other features on this right half (described below) to pick maximum and minimum values to be plotted during Phase II.

Variable Selection Scrollbar

(right edge) scrolls through your previously selected variables to let you review, edit, or clear (any of) their associated maximums and minimums.

Min *variable* [field/slider]

lets you set (with the slider) or supply (in the field) the smallest value of the currently selected variable to plot as part of a volume or volumetric slice. The allowed range of values depends on the Phase-I analysis of your specific data, and the default is the lowest value found.

Max *variable* [field/slider]

lets you set (with the slider) or supply (in the field) the largest value of the currently selected variable to plot as part of a volume or volumetric slice. The allowed range of values depends on the Phase-I analysis of your specific data, and the default is the highest value found.

X-Volume,X-Slice Resolution [field/slider]

lets you set (with the slider) or supply (in the field) an integer specifying the fraction of the data range that you will be able to visually distinguish along the X axis. Small numbers are low resolution (32 means 1/32), while large numbers are high resolution (128 means 1/128), and the default resolution is the highest available.

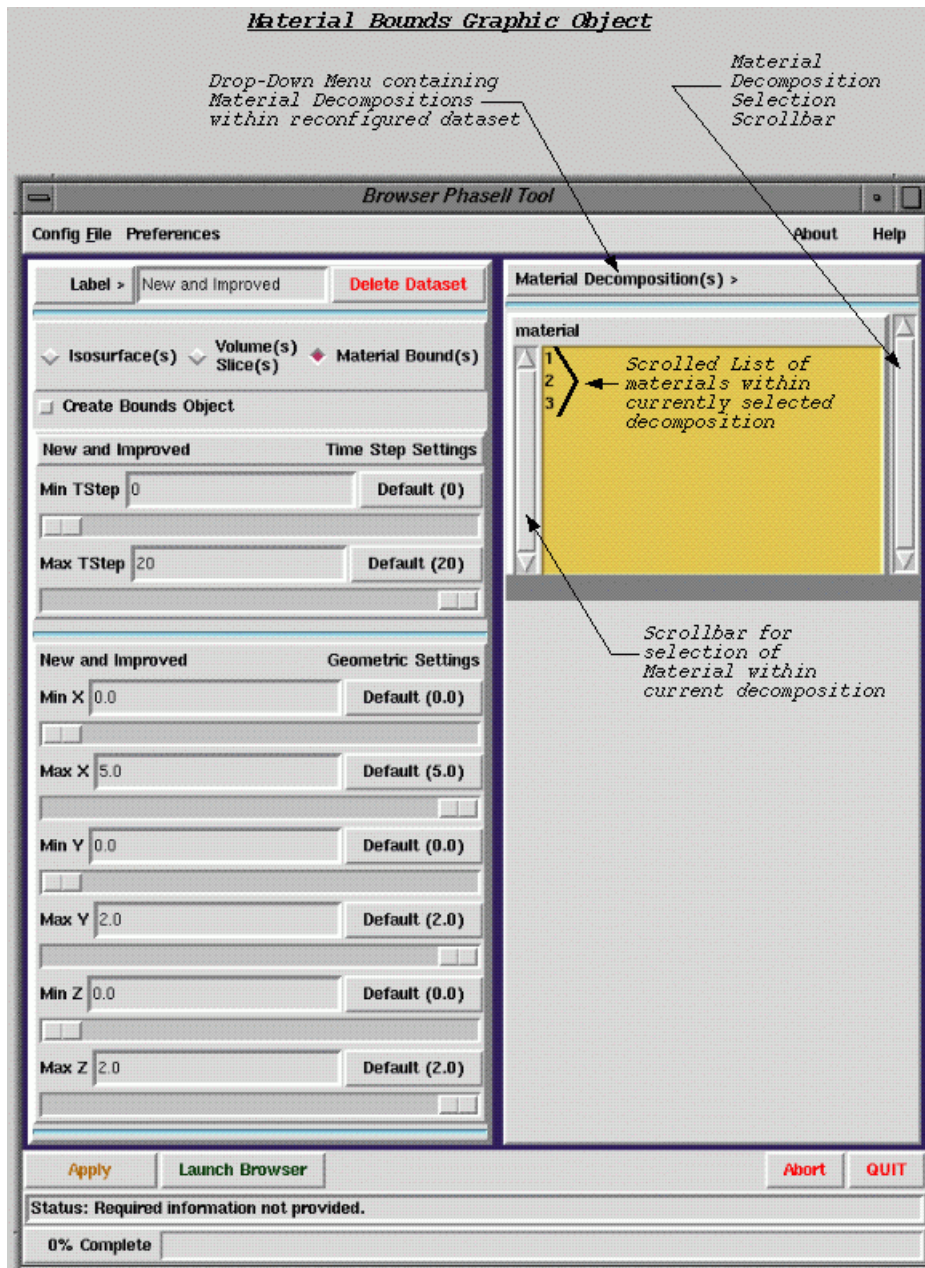
Y-Volume,Y-Slice Resolution [field/slider]

lets you set (with the slider) or supply (in the field) an integer specifying the fraction of the data range that you will be able to visually distinguish along the Y axis. Small numbers are low resolution (32 means 1/32), while large numbers are high resolution (128 means 1/128), and the default resolution is the highest available.

Z-Volume,Z-Slice Resolution [field/slider]

lets you set (with the slider) or supply (in the field) an integer specifying the fraction of the data range that you will be able to visually distinguish along the Z axis. Small numbers are low resolution (32 means 1/32), while large numbers are high resolution (128 means 1/128), and the default resolution is the highest available.

Phase II Material Boundaries



The Phase-II RIGHT half that specifically supports material boundaries (shown above) appears just in case you activate the material boundaries radio button near the top of the Phase-II LEFT half.

The user-interaction features of the Phase-II Tool material boundaries right half include:

Material Decompositions [menu]

offers a pull-down menu that lists the material decompositions found in your data during the Phase-I analysis. You can select any decomposition to be plotted for display during Phase II.

Material Decomposition Selection Scrollbar

(right edge) scrolls through your previously selected decompositions to let you pick one for further processing.

Scrolled List of Materials

lets you review all the materials that comprise the currently selected material decomposition, to select (by clicking) those whose boundaries you want plotted for display.

Setting and Monitoring Choices

This section explains the special TSB windows devoted to setting properties and preferences, and to monitoring those settings and their effects.

Setting Object Properties

Specific to each kind of graphical object that you can make with TSB (the general bounding box, as well as isosurfaces, material boundaries, and volumes with slices) is a property-setting window spawned by clicking on the PROPERTIES (rightmost) button offered on the [Browser Interface](#) (page 25) screen. Using any of these property-setting windows (described here) changes the features of the currently displayed graphical object (but not the "mere presentation" of that object, such as its angle of rotation or background. You control presentation on the [main viewer](#) (page 20) window.). The timestep feature alone is controlled from a slider on the (bottom of the) Browser Interface itself (because timesteps are common to all graphical objects made by TSB).

The four property-setting windows and their controls include:

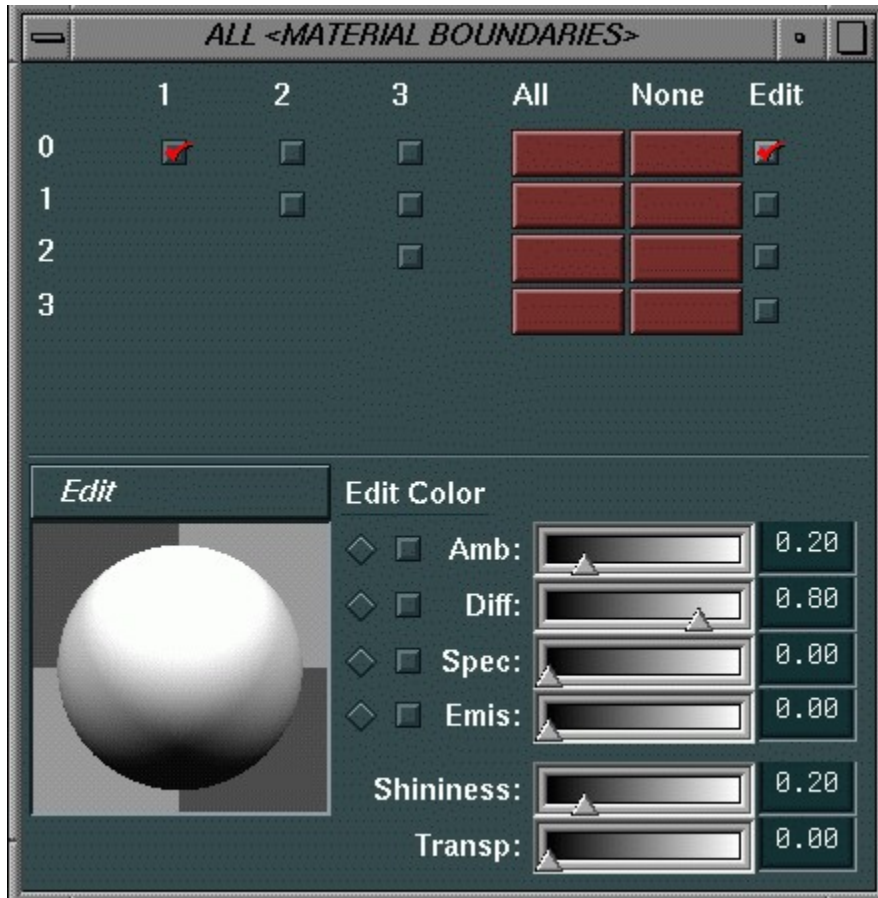
BOUNDING-BOX PROPERTIES.



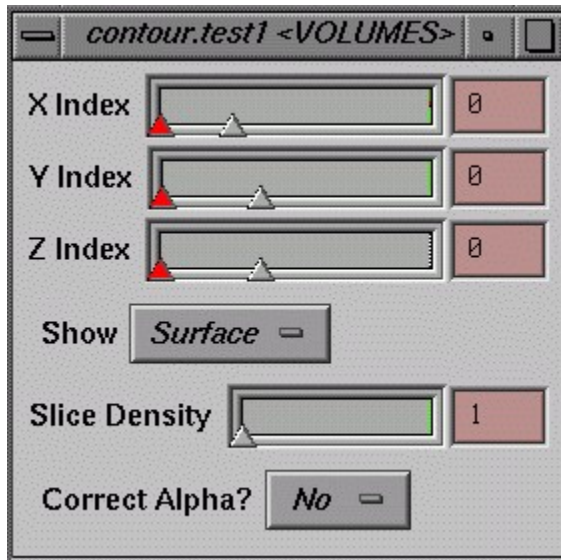
ISOSURFACE PROPERTIES.



MATERIAL BOUNDARIES PROPERTIES.



VOLUME/SLICE PROPERTIES.



Setting Viewer Preferences

Selecting the PREFERENCES item under the FILE menu on the main TSB viewer ([Interactive Slicer](#) (page 20)) spawns a special "Preferences Dialog Box," whose controls somewhat change the way the viewer runs:



Examples

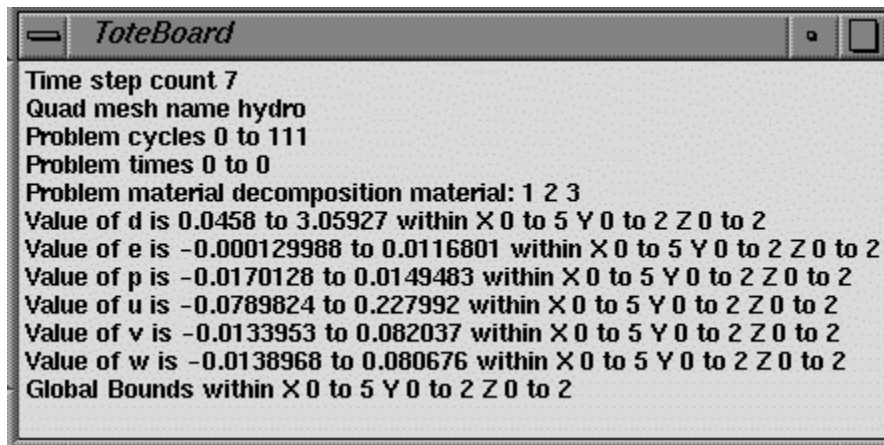
Multiple Views of One Visualization

GOAL: To make one new graphical object and then examine it visually in several different ways by using the display controls offered with the TSB main viewer ([Interactive Slicer](#) (page 20)).

STRATEGY: This example assumes that you already have a TSB registry that corresponds to a set of previously converted ("reconfigured") mesh data from Phase I, and that you now want to make and display one new "visualization" (graphical object) that represents that data. The six steps below make a sliceable volume ((1) to (3)), display it in the viewer window (4), and manipulate both the presentation of the object (5) and its own visual properties (6).

(1) Examine the Toteboard window.

This summarizes the properties that TSB discovered during the data-conversion phase (here, for instance, the first line reveals 7 timesteps, and the last line reveals the largest possible boundaries for any displayed volume you might make). These are the limits of the data set and the default settings when you make a graphical object during TSB's Phase II.



(2) Specify your desired visualization.

(a) on the top LEFT side of the Phase II Tool window (shown below), supply a name ("label") for your object (here, "contour.test1") and click on the kind of object you want to make (here, Volumes/Slices). TSB automatically fills in the default timestep settings (here, the 7 steps from 0 to 6) and below that the default geometric settings (for example, 0 to 5 along the x-axis, as indicated in the Toteboard's last line).

(b) On the RIGHT side (specific to each kind of graphical object), you can select a plotable variable (the default here is the first one on the Toteboard, namely d) and the display resolution along each axis (the default is 128, changed here with the slider only for the x-axis, to 684).

The screenshot shows the 'Browser PhaseII Tool' window with a menu bar (Config, File, Preferences, About, Help) and a toolbar. The main interface is divided into two panes. The left pane contains settings for a dataset labeled 'contour.test1'. It has radio buttons for 'Isosurface(s)', 'Volume(s) Slice(s)' (selected), and 'Material Bound(s)'. Below is a 'Create Bounds Object' section with 'Time Step Settings' (Min TStep: 0, Max TStep: 6) and 'Geometric Settings' (Min/Max X: 0.0 to 5.0, Min/Max Y: 0.0 to 2.0, Min/Max Z: 0.0 to 2.0). The right pane shows 'Variable >' settings for variable 'd', with 'Min d' (0.049) and 'Max d' (3.06037). It also has 'Variable Ranges' for 'X-Volume' (684), 'X-Slice' (684), 'Y-Volume' (128), 'Y-Slice' (128), 'Z-Volume' (128), and 'Z-Slice' (128). At the bottom, there are buttons for 'Apply', 'Update Browser Registry', 'Update Browser Data', 'Abort', and 'QUIT'. A status bar at the very bottom indicates 'Status: Browser Volume/Slice Data completed in 64.021 seconds (1.067 minutes). 100% Complete' with a progress bar.

Browser PhaseII Tool

Config File Preferences About Help

Label > contour.test1 Delete Dataset

Isosurface(s) Volume(s) Slice(s) Material Bound(s)

Create Bounds Object

contour.test1 Time Step Settings

Min TStep 0 Default (0)

Max TStep 6 Default (6)

contour.test1 Geometric Settings

Min X 0.0 Default (0.0)

Max X 5.0 Default (5.0)

Min Y 0.0 Default (0.0)

Max Y 2.0 Default (2.0)

Min Z 0.0 Default (0.0)

Max Z 2.0 Default (2.0)

Variable >

d Variable Ranges

Min d 0.049 Default (0.0458)

Max d 3.06037 Default (3.05927)

X-Volume 684 Default (128)

X-Slice 684 Default (128)

Y-Volume 128 Default (128)

Y-Slice 128 Default (128)

Z-Volume 128 Default (128)

Z-Slice 128 Default (128)

Apply Update Browser Registry Update Browser Data Abort QUIT

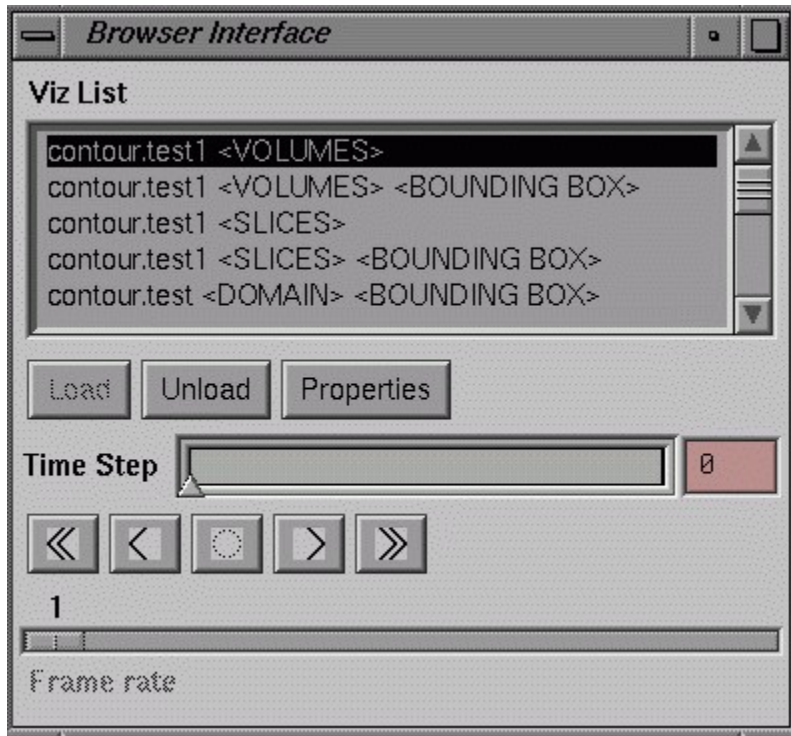
Status: Browser Volume/Slice Data completed in 64.021 seconds (1.067 minutes).

100% Complete

(3) Add your graphical object to TSB's Viz List.

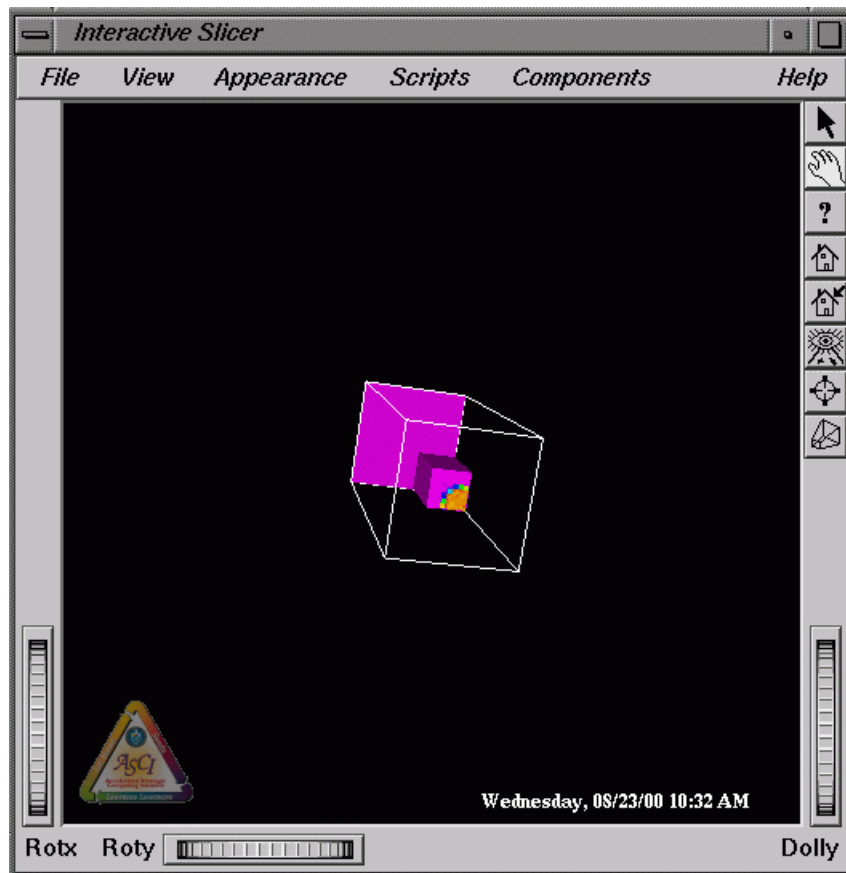
(a) On the bottom (left) of the Phase II Tool, click on the APPLY button to make the object (here, a sliceable volume) that you have specified (the status line reports processing progress).

(b) Then click on UPDATE BROWSER REGISTRY to put the label for your newly created graphical object (here, contour.test1) at the top of the Viz List in the small Browser Interface window (shown below) that accompanies the main TSB viewer. Note also that the default timestep is 0 (out of the 7 available here).



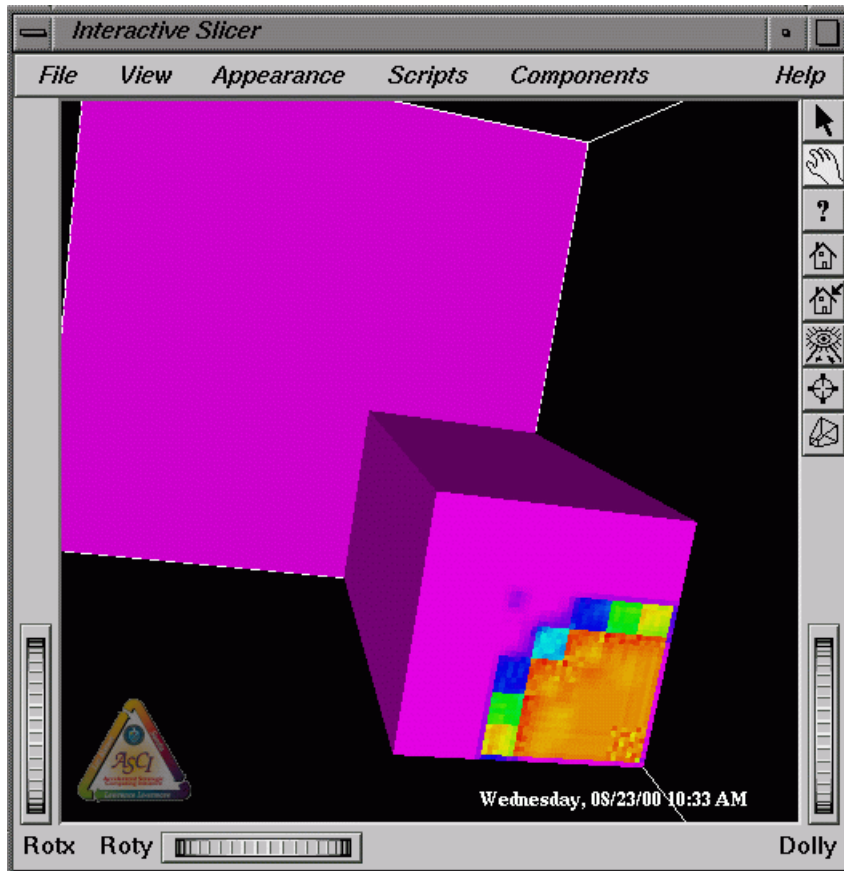
(4) Display your visualization.

- (a) On the Browser Interface, click on your graphical object's label line to select it (black highlight shown above).
- (b) Then click on the LOAD button to make your object appear in the TSB main viewer (Interactive Slicer) window, below. In this case, it appears (with the ASCI logo and date stamp along the bottom) as a large cube with a smaller cube placed against one interior corner.
- (c) Use the rotation "wheels" (lower left) or the hand cursor (upper right) to rotate the object so that the interesting details face toward the front (as they do in the view shown below).



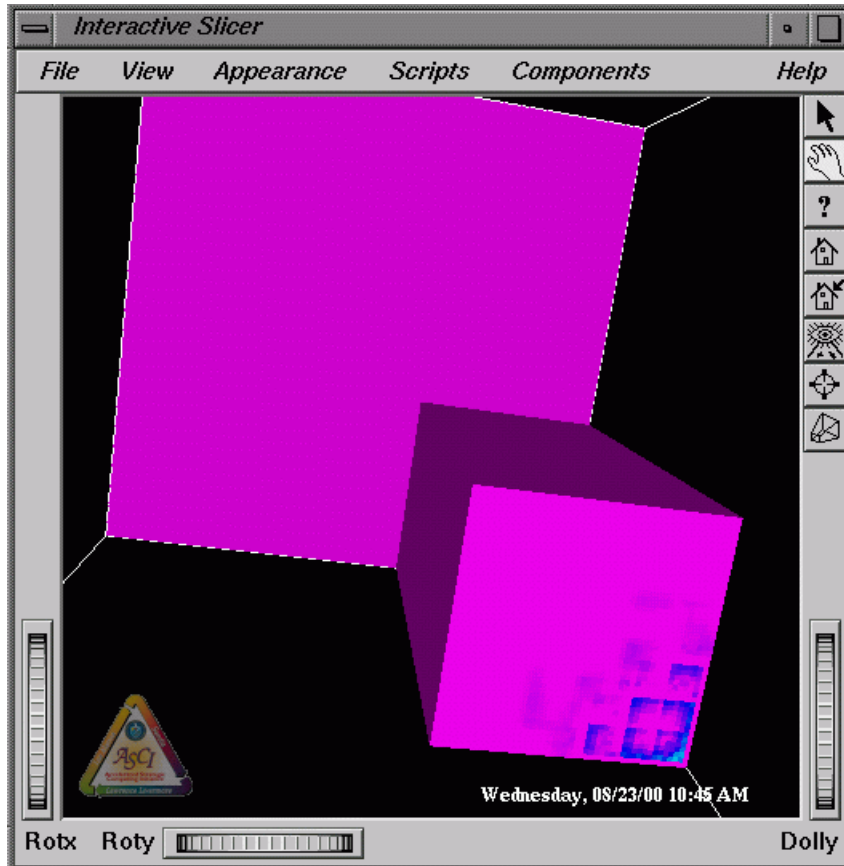
(5) Change the object's presentation.

Use any of the controls ("wheels," special cursors, menu subitems) offered directly on the TSB main viewer (Interactive Slicer (page 20)) window to change how your graphical object is presented without changing the properties of the object itself. For example, here the Dolly "wheel" (lower right edge) was used to zoom in on (change the apparent distance to) the interesting details on the front face of the inner cube, without changing those details or any other aspects of the displayed visualization.



(6) Change the object's properties.

- (a) Use the slider or left/right arrow buttons on the lower half of the [Browser Interface](#) (page 25) to change the timestep displayed for your graphical object. For example, the viewer window below shows the same sliced volume as before, but at timestep 3 (advanced from the original display of default timestep 0 above), without changing the rotation, apparent distance, or any "merely presentational" features of the visualization.
- (b) Use the PROPERTIES button (on the right) on the Browser Interface to spawn a separate property-setting window specific to each kind of graphical object if you want to change the object's nontimestep properties (such as the direction of slices or the object's transparency). See the [Setting Object Properties](#) (page 40) section above for details.



Multiple Visualizations of One Data Set

This section is under development.

Appendix A: SILO File Naming Conventions

Appropriate input for the TSB data-preparation routines is a SILO file family, which always consists of one or more family *members*. Each member in turn may be a single file or a sequence of files. To be identified by TSB as a valid family of SILO files, each file in the family must be named according to this format:

root-name[*sequence-number*][*.suffix*]

where

root-name is any character string excluding dot (.) or slash (/), and must be the same for every file in the family.

sequence-number

(optional) is a fixed-length sequence of digits padded on the left, if necessary, with leading zeros. The sequence numbers of members in the family must be monotonically increasing but need not be consecutive (for example, results0137.silo, results0139.silo, results0184.silo).

If a file family has only one member, no sequence number is needed (for example, results.silo) but is still allowed (for example, results75.silo).

If a family member consists of more than one file, all files of that member have the same sequence number and differ by use of a separate numerical suffix (below).

suffix

(optional) must be either (1) the string 'silo' or (2) a left-justified integer (leading zeros NOT required) that specifies a file's ordinal placement within a family member of more than one file. A SILO family member of more than one file must use consecutive, increasing, integer numbers as its file name suffixes (for example, results0184.5, results0184.6, results0184.7). The first number in such a series of suffixes may be any (unsigned) integer or, optionally, may be omitted (along with the dot that precedes it; for example: sunbeam, sunbeam.1 sunbeam.2, sunbeam.3).

The summary chart below gives comparative examples of SILO file-family names arranged to visually reveal the rules presented above.

Examples of SILO file-family names

| | One member | Multiple members |
|------------------------------|---|---|
| One file per member | results.silo fengak_ARM_28 | lazma0107.silo lazma0109.silo lazma0300.silo lazma0404.silo |
| Multiple files per member | maxout_1492.9 maxout_1492.10 maxout_1492.11 sunbeam sunbeam.1 sunbeam.2 sunbeam.3 | maxout_385.3 maxout_385.4 maxout_385.5 maxout_386.1 maxout_386.2 maxout_390.1 maxout_390.2 maxout_395.1 (a 1-file member) |

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Keyword Index

To see an alphabetical list of keywords for this document, consult the [next section](#) (page 57).

| Keyword | Description |
|-------------------------------------|---|
| entire | This entire document. |
| title | The name of this document. |
| scope | Topics covered in this manual. |
| availability | Where these programs run. |
| who | Who to contact for assistance. |
| introduction | Role and goals of TSB. |
| strategies | Strategies for effective TSB use. |
| possible-uses | Output alternatives; tool alternatives. |
| constraints | Prerequisites and pitfalls. |
| prerequisites | What TSB assumes about your input. |
| pitfalls | Known limitations or problems. |
| tsb-internals | Underlying features clarified, compared. |
| data-details | TSB's three data-preparation phases. |
| tsb-directories | TSB directory and file structure. |
| tsb-labels | Two kinds of TSB labels compared. |
| typical-paths | Strategic TSB usage advice. |
| path-diagram | Typical path among TSB windows, buttons. |
| path-steps | Typical steps to make, view TSB graphics. |
| installation | How to install, configure TSB. |
| execution | Specific TSB execution instructions. |
| tsb-usage | How to run TSB. |
| tsb-defaults | Default settings and configurations. |
| errors | How TSB reports errors. |
| options | TSB windows and their options explained. |
| viewing-output | Windows/options to display output. |
| interactive-slicer | Main TSB viewer window, options. |
| browser-interface | Browser control window, options. |
| preparing-data | Windows/options to prepare data. |
| phase-1-tool | Phase-I (conversion) window, options. |
| phase-2-tool | Phase-II (left half) window, options. |
| isosurfaces | Phase-II (right) isosurface options. |
| slices | Phase-II (right) slices options. |
| volumes | Phase-II (right) volumes options. |
| material-boundaries | Phase-II (right) mat. bounds. options. |
| setting-choices | Windows/options to set, monitor choices. |
| object-properties | Property-setting windows, options. |
| viewer-preferences | Preference-setting window, options. |
| examples | Sample TSB sessions with output shown. |
| many-views | TSB example: one object, several views. |
| many-objects | TSB example: one data set, several objects. |
| silo-names | SIL0 file-name rules explained. |
| index | The structural index of keywords. |

a
date
revisions

The alphabetical index of keywords.
The latest changes to this manual.
The complete revision history.

Alphabetical List of Keywords

| Keyword | Description |
|----------------------------|---|
| ----- | ----- |
| <u>a</u> | The alphabetical index of keywords. |
| <u>availability</u> | Where these programs run. |
| <u>browser-interface</u> | Browser control window, options. |
| <u>constraints</u> | Prerequisites and pitfalls. |
| <u>data-details</u> | TSB's three data-preparation phases. |
| <u>date</u> | The latest changes to this manual. |
| <u>entire</u> | This entire document. |
| <u>errors</u> | How TSB reports errors. |
| <u>examples</u> | Sample TSB sessions with output shown. |
| <u>execution</u> | Specific TSB execution instructions. |
| <u>index</u> | The structural index of keywords. |
| <u>installation</u> | How to install, configure TSB. |
| <u>interactive-slicer</u> | Main TSB viewer window, options. |
| <u>introduction</u> | Role and goals of TSB. |
| <u>isosurfaces</u> | Phase-II (right) isosurface options. |
| <u>many-objects</u> | TSB example: one data set, several objects. |
| <u>many-views</u> | TSB example: one object, several views. |
| <u>material-boundaries</u> | Phase-II (right) mat. bounds. options. |
| <u>object-properties</u> | Property-setting windows, options. |
| <u>options</u> | TSB windows and their options explained. |
| <u>path-diagram</u> | Typical path among TSB windows, buttons. |
| <u>path-steps</u> | Typical steps to make, view TSB graphics. |
| <u>phase-1-tool</u> | Phase-I (conversion) window, options. |
| <u>phase-2-tool</u> | Phase-II (left half) window, options. |
| <u>pitfalls</u> | Known limitations or problems. |
| <u>possible-uses</u> | Output alternatives; tool alternatives. |
| <u>preparing-data</u> | Windows/options to prepare data. |
| <u>prerequisites</u> | What TSB assumes about your input. |
| <u>revisions</u> | The complete revision history. |
| <u>scope</u> | Topics covered in this manual. |
| <u>setting-choices</u> | Windows/options to set, monitor choices. |
| <u>silos-names</u> | SIL0 file-name rules explained. |
| <u>slices</u> | Phase-II (right) slices options. |
| <u>strategies</u> | Strategies for effective TSB use. |
| <u>title</u> | The name of this document. |
| <u>tsb-defaults</u> | Default settings and configurations. |
| <u>tsb-directories</u> | TSB directory and file structure. |
| <u>tsb-internals</u> | Underlying features clarified, compared. |
| <u>tsb-labels</u> | Two kinds of TSB labels compared. |
| <u>tsb-usage</u> | How to run TSB. |
| <u>typical-paths</u> | Strategic TSB usage advice. |

viewer-preferences
viewing-output
volumes
who

Preference-setting window, options.
Windows/options to display output.
Phase-II (right) volumes options.
Who to contact for assistance.

Date and Revisions

| Revision Date ----- | Keyword Affected ----- | Description of Change ----- |
|---------------------------|--|---|
| 13Sep00 | <u>data-details</u> <u>path-diagram</u> <u>path-steps</u> <u>tsb-usage</u> <u>phase-2-tool</u> <u>object-properties</u> <u>viewer-preferences</u> <u>examples</u> <u>silos-names</u> | Registry details clarified. UPDATE, PROPERTIES buttons clarified. Many links, details added. Expanded, view substeps added. Links and details added. New section on prop-setting windows. New section of pref-setting window. Much expanded with detailed case. New appendix on naming rules. |
| 21Aug00 | entire | First edition of LC TSB manual. |

TRG (13Sep00)

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